MEDICAL AND DENTAL EDUCATION

A Core Syllabus for the Teaching of Gross Anatomy of the Thorax to Medical Students

BERNARD J. MOXHAM [1,2]* SHIBY STEPHENS,[1] DEEPAK SHARMA,[2] AND MARIOS LOUKAS [2]

[1]*Cardiff School of Biosciences, Cardiff University, Museum Avenue, Cardiff, CF10 3AX, Wales, United Kingdom*
[2]*St George's University, Grenada, West Indies*

Discussion is ongoing concerning the need to ensure the clinical relevance of the biomedical sciences. However, clinical relevance within health care courses presupposes that there is internationally agreed core material to be taught and learned. For anatomy, by the initial use of Delphi Panels that comprise anatomists, scientists, and clinicians, the International Federation of Associations of Anatomists (IFAAs) is developing internationally accepted core syllabuses for all anatomical sciences disciplines in the health care professions. In this article, the deliberations of a Delphi Panel for the teaching of thoracic anatomy in the medical curriculum are presented, prior to their publication on the IFAA's website. To develop the syllabus further, it is required that anatomical societies, as well as individual anatomists and clinicians, comment upon, elaborate, and amend this draft recommended syllabus. The aim is to set internationally recognized standards and thus to provide guidelines concerning the knowledge of the human thorax expected of graduating medical professionals. Such information should be borne in mind by those involved in the development of medical courses. Clin. Anat. 00:000–000, 2019.

Key words: medical education; gross anatomy; thorax; core syllabus; Delphi Panel

INTRODUCTION

Controversy persists concerning the development of medical curricula and the role of the anatomical sciences within them. Drake et al. (2002, 2009, 2014) and McBride and Drake (2018) have conducted a series of surveys of medical schools in the United States showing that the time devoted to teaching gross anatomy has declined from an average of approximately 170 hr in 2002 to 130 hr in 2018. It was also reported that this compares with approximately 350 hr in the 1950s. While 130 hr may seem a significant amount of time, in the context of the entire medical course, this corresponds merely with 3 full weeks of anatomy tuition in a year or 2% of the entire course. These changes are occurring despite anatomists, medical students and laypersons opining that gross anatomy is crucial and fundamental for medical education and training (e.g., Patel and Moxham, 2006, 2008; Moxham and Plaisant, 2006; Moxham and Moxham, 2007; Pabst, 2009; Kerby et al., 2011; Moxham et al., 2016). Globally, the range and variety of medical curricula have changed markedly from the traditional model of 2 or 3 years "preclinical studies" followed by 2 or 3 years of "clinical studies" to systems-based integrated curricula. This has led to the significant decreases in the amount of time devoted to gross anatomy and the subject is nowadays taught less as a stand-alone course but more often within

*Correspondence to: Bernard J. Moxham, Cardiff School of Biosciences, Cardiff University, Museum Avenue, Cardiff CF10 3AX, Wales, United Kingdom. E-mail: moxham@cardiff.ac.uk

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TABLE 1. [Color table can be viewed at wileyonlinelibrary.com]

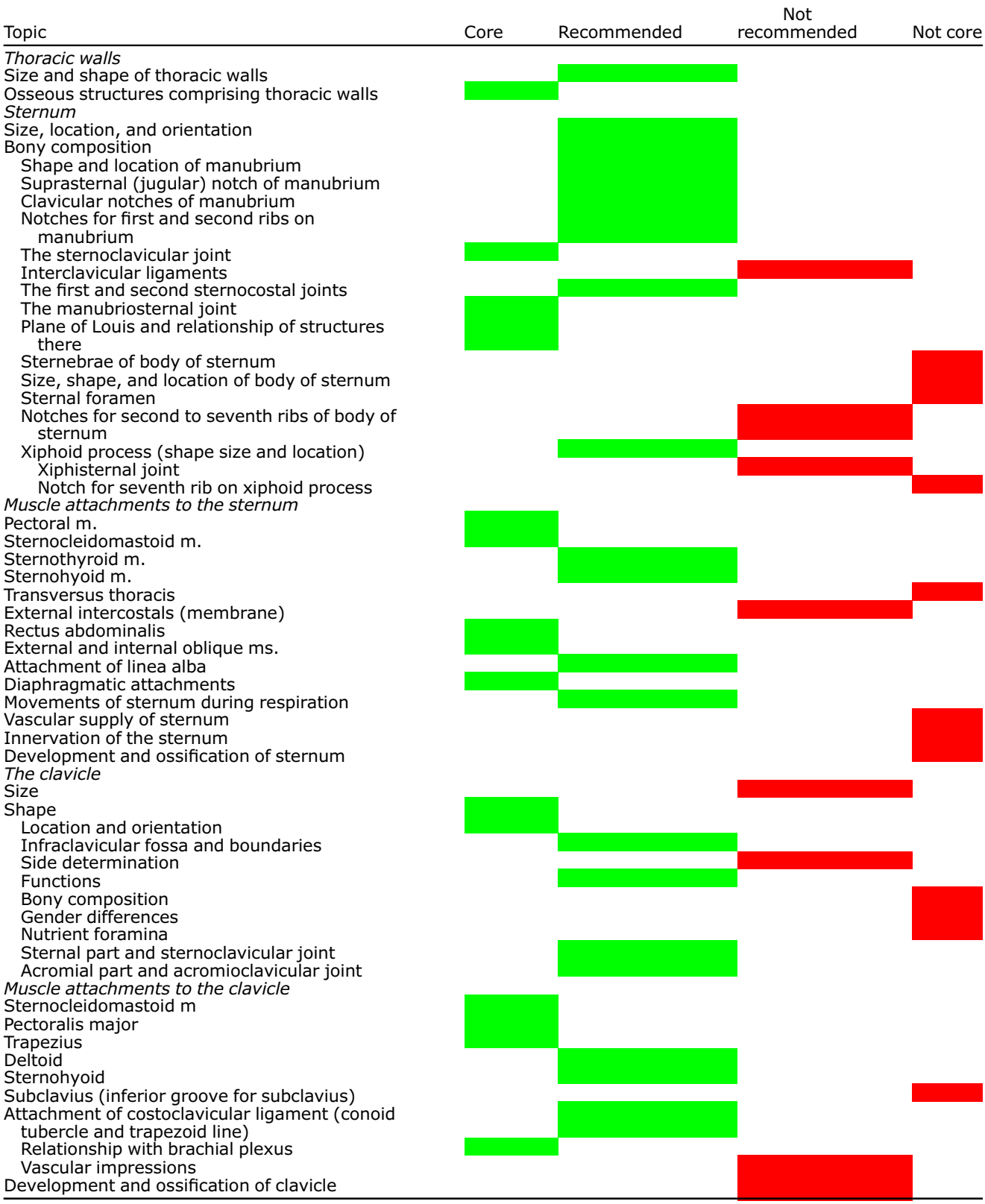
Topic	Core	Recommended	Not recommended	Not core
General topics				
Location and general functions	■			
Regions of the thorax		■		
Size and shape of thorax		■		
Surface anatomy of the thorax	■			
Auscultatory points for heart valves	■			
Counting of ribs	■			
Outline of the heart		■		
Outline of pleura		■		
Apex beat		■		
The skin of the thorax				■
Cutaneous innervation of thorax (dermatomes)			■	
Vasculature of the skin				■
Lymphatic drainage of the skin			■	
Superficial and deep fascia of the thorax			■	
Clavipectoral fascia				■
Deltopectoral triangle			■	
The breast				
Position of the breast on thorax in relation to the ribs		■		
Position of the nipple and areola on thorax			■	
Functions		■		
Development of the breasts			■	
Shape and size				■
Axillary tail		■		
Fascial relationships of breast			■	
Submammary space				
Subareolar muscle				■
Glands of the nipple and areola			■	
Montgomery's tubercles				
Lobes and ducts of the breast		■		
Suspensory ligaments				
Arterial supply of the breast	■			
Venous drainage of the breast	■			
Lymphatic drainage of the breast	■			
Innervation of the breast		■		
Accessory breast tissue				■
Accessory nipples				
Changes with pregnancy and lactation		■		
Changes with age			■	
The male breast				■
Milk line				
Cooper's ligament		■		
Retromammary space			■	

horizontally and/or vertically integrated medical courses, or even as optional (elective) courses (see Moxham and Pais, 2016; McBride and Drake, 2018).

Adopting different approaches for teaching gross anatomy can be beneficial if they accord with an understanding of medical students' different learning styles. On the other hand, care must be taken to ensure that diversity does not lead to a lack of consistency, reliability, and transparency in medical education that renders great diversity in standards from medical school to medical school. Such concerns would not be so problematic if examination procedures and practices existed that ensured uniform standards both nationally and internationally and if there were internationally recognized core syllabuses for the anatomical sciences.

There have recently been worthy attempts to develop core syllabuses for gross anatomy in general (Leonard et al., 2000; Griffioen et al., 1999; McHanwell et al., 2007; Orsbon et al., 2014; Smith et al., 2016a, 2016b; Connolly et al., 2018; Finn et al., 2018). Most have been concerned with devising learning outcomes and not with listing core topics. Alternatively, more "specialized" core syllabuses for the anatomical sciences concerned with core topics have been published through the auspices of the IFAA for head and neck anatomy (Tubbs et al., 2014; Tubbs and Paulk, 2015), for neuroanatomy (Moxham et al., 2015), for embryology and teratology (Fakoya et al., 2017), for the musculoskeletal system

TABLE 2. [Color table can be viewed at wileyonlinelibrary.com]



Topic	Core	Recommended	Not recommended	Not core
Thoracic walls				
Size and shape of thoracic walls				
Osseous structures comprising thoracic walls				
Sternum				
Size, location, and orientation				
Bony composition				
Shape and location of manubrium				
Suprasternal (jugular) notch of manubrium				
Clavicular notches of manubrium				
Notches for first and second ribs on manubrium				
The sternoclavicular joint				
Interclavicular ligaments				
The first and second sternocostal joints				
The manubriosternal joint				
Plane of Louis and relationship of structures there				
Sternebrae of body of sternum				
Size, shape, and location of body of sternum				
Sternal foramen				
Notches for second to seventh ribs of body of sternum				
Xiphoid process (shape size and location)				
Xiphisternal joint				
Notch for seventh rib on xiphoid process				
Muscle attachments to the sternum				
Pectoral m.				
Sternocleidomastoid m.				
Sternothyroid m.				
Sternohyoid m.				
Transversus thoracis				
External intercostals (membrane)				
Rectus abdominalis				
External and internal oblique ms.				
Attachment of linea alba				
Diaphragmatic attachments				
Movements of sternum during respiration				
Vascular supply of sternum				
Innervation of the sternum				
Development and ossification of sternum				
The clavicle				
Size				
Shape				
Location and orientation				
Infraclavicular fossa and boundaries				
Side determination				
Functions				
Bony composition				
Gender differences				
Nutrient foramina				
Sternal part and sternoclavicular joint				
Acromial part and acromioclavicular joint				
Muscle attachments to the clavicle				
Sternocleidomastoid m				
Pectoralis major				
Trapezius				
Deltoid				
Sternohyoid				
Subclavius (inferior groove for subclavius)				
Attachment of costoclavicular ligament (conoid tubercle and trapezoid line)				
Relationship with brachial plexus				
Vascular impressions				
Development and ossification of clavicle				

TABLE 3. [Color table can be viewed at wileyonlinelibrary.com]

Topic	Core	Recommended	Not recommended	Not core
The ribs (costae)				
Number of ribs				
Sizes of ribs				
True, false, and floating ribs				
Side determination				
Bony composition of the ribs				
Movements of ribs during respiration				
Vasculature of the ribs				
Innervation of the ribs				
Development and ossification of ribs				
Features of a typical rib				
Shaft				
Head				
Neck and tubercle				
Anterior end and costal cartilage				
Costal groove				
Impressions				
Articulations of costal cartilages with sternum				
Articulations of the false ribs				
Cervical rib				
Atypical ribs—first				
Impressions on first rib				
Atypical ribs—second				
Impressions on second rib				
Atypical ribs—10th to 12th				
Joints of costal heads with vertebrae				
Joints of tubercles with vertebrae				
Muscle attachments to ribs				
Scalene muscles from neck				
Serratus anterior				
Serratus posterior				
Subclavius				
Pectoralis ms.				
Rectus abdominalis				
Levator costae				
Intercostal ms. and membranes				
Iliocostalis thoracis				
Erector spinae				
Latissimus dorsi				
Ligaments attached to ribs				
Radiate ligaments				
Intraarticular				
Costotransverse ligaments				
Thoracolumbar fascia				
The intercostal spaces and contents				
Thoracic vertebrae				
Number				
Size, shape, and location				
Development and ossification of thoracic vertebrae				
Typical features of a thoracic vertebra				
Ligaments of the thoracic vertebrae				
Vertebrae are assessed in detail within the core syllabus for the back				

(Webb et al., 2018) and for oral anatomy, embryology, and histology for dentistry (Moxham et al., 2018).

Using the IFAA-approved methodologies (Moxham et al., 2014) previously used to devise their core syllabuses, we here present the findings of a Delphi Panel commissioned to develop a core syllabus within medicine for the gross anatomy of the human thorax.

METHODS

Guiding principles for the development of core syllabuses have been approved by the IFAA and these have previously been published and extensively discussed (Moxham et al., 2014). Synoptically, the process involves three stages.

TABLE 4. [Color table can be viewed at wileyonlinelibrary.com]

Topic	Core	Recommended	Not recommended	Not core
Thoracic inlet				
Constituent parts				
Structures passing through the thoracic inlet				
Rotter's nodes				
Sentinel node				
Diaphragm				
Location and shape				
Changes to shape of diaphragm during respiration				
Changes to shape of diaphragm during standing and lying down				
Surface anatomy				
Function and movements during respiration				
Bucket handle				
Pump handle				
Paradoxical respiration				
Accessory muscles of respiration				
Development of the diaphragm				
Central tendon				
Right, left, and middle folia				
Domes				
Attachments of the diaphragm				
Sternal				
Costal				
Lumbar				
Medial and lateral arcuate ligaments				
Crura				
Surface coverings superiorly				
The cardiac plateau				
Surface coverings of the inferior surface				
Apertures of the diaphragm				
Aortic hiatus				
Level of thoracic vertebra				
Oesophageal aperture				
Level of the thoracic vertbra				
Opening also for vagus, gastric nerves, and vessels				
Relationship with right crus				
Phrenooesophageal ligament				
Caval opening				
Level of eighth thoracic vertebra				
Opening in central tendon				
Openings for splanchnic nerves				
Openings for left phrenic nerve				
Blood supply of diaphragm				
Intercostal and subcostal as				
Inferior phrenic as				
Superior phrenic as.				
Venous drainage of diaphragm				
Lymphatic drainage of diaphragm				
Innervation of diaphragm				
Phrenic ns. (motor)				
Intercostal ns.				
Phrenic ganglia				
Accessory phrenic ns.				

Stage 1

A Delphi Panel is constructed consisting of between 20 and 30 experts in the specified field drawn from different countries. The panel is given a detailed list of topics within their remit to evaluate. Thus, the IFAA syllabuses are not based upon a "broad brush" approach or involve the development of learning outcomes. The panel for thoracic anatomy for the medical course consisted of 22 members (6 from the United States; 2 from United Kingdom and Ireland; 2 from Greece; 2 from the West Indies; 1 from Italy;

TABLE 5. [Color table can be viewed at wileyonlinelibrary.com]

Topic	Core	Recommended	Not recommended	Not core
Intrinsic chest wall muscles				
External intercostals				
Attachments				
Functions				
Innervation				
Blood supply				
Internal intercostals				
Attachments				
Functions				
Innervation				
Blood supply				
Innermost intercostals				
Attachments				
Functions				
Innervation				
Blood supply				
Subcostales				
Attachments				
Functions				
Innervation				
Blood supply				
Transversus thoracis				
Attachments				
Functions				
Innervation				
Blood supply				
Levatores costarum				
Attachments				
Functions				
Innervation				
Blood supply				
Serratus posterior superior				
Attachments				
Functions				
Innervation				
Blood supply				
Serratus posterior inferior				
Attachments				
Functions				
Innervation				
Blood supply				
Sternalis				
Attachments				
Functions				
Innervation				
Blood supply				
Arteries of the chest wall				
Internal thoracic a				
Origin, course, and distribution				
Sternal branches				
Anterior intercostals				
Perforating branches				
Musculophrenic				
Superior intercostal a				
Origin, course, and distribution				
Posterior intercostals				
Origin, course, and distribution				
Dorsal branch				
Collateral intercostal branch				
Muscular branches				
Lateral cutaneous branch				
Veins of the chest wall				
Internal thoracic v.				
Course and drainage				
Left superior intercostal v.				

(Continues)

TABLE 5. Continued

Topic	Core	Recommended	Not recommended	Not core
Course and drainage				
Posterior intercostal vs. Course and drainage				
Lymphatic drainage of chest wall				
Parasternal (internal thoracic) nodes				
Intercostal nodes				
Diaphragmatic nodes				
Innervation of the chest wall				
Thoracic ventral spinal rami				
Intercostal ns. Course, functions, distribution				
Subcostal n. course, functions, distribution				
Thoracic dorsal spinal rami				
Medial and lateral branches				
Medial and lateral cutaneous branches				

TABLE 6. [Color table can be viewed at wileyonlinelibrary.com]

Topic	Core	Recommended	Not recommended	Not core
Intrathoracic cavities				
The pleural cavity and lungs				
Surface anatomy of the extent of the pleural cavities				
Development of the pleural cavities				
Functions of the pleura				
Layers of pleura				
The basic histological features of the pleura				
The pleural space and pleural fluid				
Functions of pleural fluid				
Secretion and absorption of pleural fluid				
Pleural fluid pressures				
Folds of pleura at reflection sites (retrosternal, interlobar fissures and the azygooesophageal recess) visualized radiographically				
Extent of the parietal pleura on thoracic structures (i.e., costovertebral, diaphragmatic, cervical and mediastinal pleura)				
Inferior pulmonary ligaments				
The costomediastinal recess				
The costodiaphragmatic recess				
The visceral pleura				
The innervation of the pleura				
The vasculature of the pleura				
The lymphatic drainage of the pleura				
The lungs—development of				
Functions of the lungs				
Appearances and texture of the lungs				
Surfaces iof the lungs (apex, base, costal surface, medial surface)				
Impressions of mediastinal structures on the cadaveric lung				
Side determination of the lung				
Pulmonary borders				
The fissures and lobes of the lungs—differences between right and left				
Surface anatomy of the oblique and transverse fissures of the lungs				
The cardiac notch				

(Continues)

TABLE 6. Continued

Topic	Core	Recommended	Not recommended	Not core
Lingula				
Bronchopulmonary segments (concept)				
Bronchopulmonary segments (detailed description)				
Hilia (bare areas for transmission of structures in and out of lungs)				
Shape of hila and the pulmonary ligament				
The bronchi in the hila				
The pulmonary vessels in the hila				
Bronchial vessels				
Lymph nodes in and around the hilum				
Differences between right and left hila				
Pulmonary plexuses				

TABLE 7. [Color table can be viewed at wileyonlinelibrary.com]

Topic	Core	Recommended	Not recommended	Not core
The mediastinum				
Location and subdivisions				
Plane of Louis and relationships at this plane				
The superior mediastinum				
Relationship with neck and thoracic inlet				
List of contents within superior mediastinum				
Thymus—shape and functions				
Thymus—development and postnatal development				
Thymus—positions and relations				
Thymus—vascular supply				
Thymus—lymphatic drainage				
Thymus—innervation				
The esophagus, trachea and bronchi				
Functions of esophagus				
Course and relationships of esophagus				
Oesophageal sphincters				
The esophagus—vascular supply				
The esophagus—lymphatic drainage				
The esophagus—innervation				
Anatomical constrictions of the esophagus				
Trachea and bronchi				
Course of trachea				
Structure of trachea				
Relationships of structures with trachea				
Carina trachea				
Courses of brochi				
Differences between right and left main bonchi				
Relationships of structures with bronchi				
Vasculature of trachea and bronchi				
Innervation of trachea and bronchi				
Other superior mediastinal structures				
Ascending aorta and aortic arch				
Origin of coronary arteries				
Origin of brachiocephalic artery				
Course and distribution of brachiocephalic artery				
Origin of the left carotid artery				
Origin of the left subclavian artery				
Course of the pulmonary trunk and arteries				

(Continues)

TABLE 7. Continued

Topic	Core	Recommended	Not recommended	Not core
Ligamentum arteriosum				
Course of the pulmonary veins				
Course of left vagus and recurrent laryngeal n.				
Brachiocephalic veins				
Superior vena cava				
Azygos v.				
Thoracic duct				
Course of thoracic duct within the thorax				
Development of thoracic duct				
Lymphatics in superior mediastinum				
Cardiac plexus				
Right vagus				
Phrenic ns				
Origins of sternhyoid and sternothyroid ms				
Anterior mediastinum				
Location of anterior mediastinum				
Course and branches of the internal thoracic artery				
Course and tributaries of the internal thoracic vein				
Remains of thymus				
Sternopericardial ligaments				
Lymph nodes in the anterior mediastinum				
Mediastinal branches of the internal thoracic as				
Pleural reflections				
Posterior mediastinum				
Location of the posterior mediastinum				
Boundaries of the posterior mediastinum				
Pleural recesses in the posterior mediastinum (interaorticooesophageal, interazygooesophageal)				
Descending thoracic aorta (location)				
Vertebral levels for beginning and end of descending thotacic aorta				
Descending thoracic arota (branches)				
Pericardial branches				
Bronchial branches				
Oesophageal branches				
Mediastinal branches				
Posterior intercostal arteries				
Superior phrenic arteries				
Subcostal artery				
Descending thoracic aorta through diaphragm				
Esophagus (location)				
Esophagus through diaphragm				
Azygos and hemiazygos venous system				
Origin of azygos (right ascending lumbar v. and right subcostal v.)				
Origin of hemiazgos (left ascending lumbarv and left subcostal v.)				
Tributaries of azygos v.				
Right superior intercostal vein				
5th to 11th posterior intercostal veins				
Hemiazygos vein				
Lowest 4/5 left posterior intercostal veins				
Oesophageal and mediastinal vs.				
Accessory hemiazygos v.				
4th to 8th left posterior intercostal veins				
Occasional left bronchial veins				
Oesophageal veins				
Mediastinal veins				
Pericardial veins				

(Continues)

TABLE 7. Continued

Topic	Core	Recommended	Not recommended	Not core
Right bronchial veins				
Variations of the azgos system				
Thoracic duct (location)				
Tributaries of the thoracic duct				
Cisterna chyli				
Rt lymphatic duct				
Sympathetic trunks and splanchnic nerves				
Ganglia and gray and white rami communicantes				
Branches from upper five thoracic ganglia				
Postganglionic fibers to viscera				
Branches from lower seven thoracic ganglia				
Greater splanchnic nerve				
Lesser splanchnic nerve				
Least splanchnic nerve				
Vagal trunks				
Mediastinal lymph nodes				
Middle mediastinum (location and boundaries)				
Inferior vena cava				

TABLE 8. [Color table can be viewed at wileyonlinelibrary.com]

Topic	Core	Recommended	Not recommended	Not core
Pericardium				
Layers of pericardium				
Fibrous pericardium				
Parietal layer of serous pericardium				
Visceral layer of serous pericardium (epicardium)				
Vasulature of pericardium				
Innervation of pericardium				
Lymphatic drainage of pericardium				
Pericardial space and fluid				
Oblique sinus				
Transverse sinus				
Heart				
Orientation				
Size and shape				
External feature				
Grooves on cardiac surface				
Surfaces and borders				
Crux of the heart				
Base and apex				
Chambers				
Right atrium—general features				
Crista terminalis				
Pectinate muscles				
Sinus venosus				
Sinus venarum				
Right atrium proper				
Foramen ovale				
Fossa ovalis				
Limbus fossa ovalis				
Patent probe foramen ovale				
Membranous septum				
Venae chordae minimae				
Internal and external features				
Venous openings into the right atrium				
Right ventricle—general features				

(Continues)

TABLE 8. Continued

Topic	Core	Recommended	Not recommended	Not core
Internal and external features				
Septomarginal trabeculations				
Moderator band				
Septoparietal trabeculations				
Crista supraventicularis				
Subpulmonary infundibulum				
Medial papillary muscle complex (muscle of Lansici)				
Parietal free wall				
Trabeculae carnae				
Left atrium—general features				
Internal and external features				
Body				
Vestibule				
Venous component				
Fossa ovalis				
Pectinate muscles				
Opening of pulmonary veins				
Auricle/appendage				
Left ventricle—general features				
Internal and external features				
Fine trabeculations				
Inlet component				
Outlet component				
Aortic to mitral valve fiber continuity				
Valves				
Inferior vena cava valve (Eustachian)				
Chiari's network				
Valve of coronary sinus (Thebesian)				
Valve of great cardiac vein (Vieussen)				
Tricuspid valve				
Tricuspid valve leaflets				
Chordae tendinae				
Papillary muscles				
Pulmonary valve				
Opening of the pulmonary valve				
Mitral valve				
Mitral valve leaflets				
Chordae tendinae				
Papillary muscles				
Aortic valve				
Aortic valve leaflets				
Conducting system of the heart				
Sinuatrial node				
Atrioventricular node				
AV bundle of HIs				
Purinje fibers				
Right bundle branch				
Left bundle branch				
Accessory bundle of Kent				
Internodal pathways				

1 from Nigeria; 1 from South Africa; 1 from Turkey; 1 from New Zealand; 1 from Spain; 1 from Poland; 1 from India; 1 from Japan). The age ranged from 30s to 70+ years. 66% of the panelists were clinically qualified. All the panelists were full-time academics (clinical or scientific) and all but one were employed by universities. Of the nine panelists who have clinical responsibilities, 90% claimed to devote more than 20% of their time to their clinical practice and 45% devoted 50% or more of their time. Four panelists were writers of anatomy textbooks. Thirteen panelists were/have been engaged in research related to thoracic anatomy. All but one of the panelists were teachers with substantial, or considerable, teaching experience, although few were educationalists involved in pedagogic research. All panelists stated that the teaching of embryology and teratology to medical students is important or very important.

TABLE 9. [Color table can be viewed at wileyonlinelibrary.com]

Topic	Core	Recommended	Not recommended	Not core
Vasculature of the heart				
Right coronary artery				
Origin and general course and distribution				
Atrial branch				
Conal branch				
Sinuatrial nodal branch				
Right marginal branch				
Artery to the atrioventricular node				
Posterior interventricular branch (posterior descending artery [PDA])				
Variations in right coronary artery				
Left coronary artery (aka left main stem vessel)				
Origin and general course and distribution				
Anterior interventricular branch (left anterior descending artery)				
Septal perforators				
Diagonal branches				
Circumflex branch				
Left marginal artery				
Posterior interventricular branch (PDA)				
Variations in left coronary artery				
Coronary anastomosis				
Cardiac veins				
Great cardiac vein (anterior interventricular v.)				
Middle cardiac vein (posterior interventricular v.)				
Small cardiac vein				
Right marginal vein				
Oblique vein of the left atrium				
Posterior cardiac vein				
Anterior veins of right ventricle (anterior cardiac vs.)				
Venae cordis minimae				
Coronary sinus				
Lymphatic drainage of the heart				
Innervation of the heart				
Superficial cardiac plexus				
Deep cardiac plexus				
Sympathetic innervation				
Parasympathetic innervation				
Visceral afferent fibers				
Cardiac skeleton				
Triangle of Koch				
Tendon of Todaro				
Tendon of Infundibulum				
Right fibrous trigone				
Left fibrous trigone				
Central fibrous body				
Development of heart				
Assessed by Delphi Panel dealing with embryology and teratology				

The coordinators of the panel (the authors of this article) provided a draft list of topics for the panel to consider, the list being liable for amendment following comments from the panelists. The panelists subsequently had to evaluate each item/topic in the list according to whether it should be regarded as having "essential," "important," "acceptable," or "not required" status. An example of the form used by the Delphi Panel for thoracic anatomy is shown in Table 1. To enable further comments from the panelists, a blank section was available within the form for comments.

From the Delphi panelists' responses, every topic/item was analyzed by the project's coordinators in accordance with general rules followed for other core syllabuses published through the IFAA. Where more than 60% of the panelists considered an item as being essential, this was categorized as being "core". Where

TABLE 10. [Color table can be viewed at wileyonlinelibrary.com]

Topic	Core	Recommended	Not recommended	Not core
Clinical considerations				
Carcinoma of breast				
Tension of suspensory ligaments and pitting of skin				
Spread of tumors via lymphatics and veins				
Direct invasion of breast tumors				
Peau d'orange and anatomical reasons				
Anatomy associated with mastectomies				
Damage to long thoracic nerve following mastectomy				
Damage to intercostobrachial nerve following mastectomies				
Polymastia				
Polythelia				
Gynecomastia				
Inverted nipples				
Damage to n. to latissimus dorsi m.				
Effects of having cervical rib and cervical band				
Thoracic outlet syndrome				
Collection of sternal bone marrow				
Rib fractures and flail chest				
Surgical access to the chest				
Insertion of a chest drain				
Pneumothorax				
Pain and referred pain associated with the pleura				
Fluid aspiration from pleural recesses (thoracocentesis)				
Hemothorax				
Tension pneumothorax				
Pleural effusion				
Pleuricy, pleuritis				
Congenital diaphragmatic hernia				
Eventration of the diaphragm				
Congenital hiatal hernia				
Lung percussion				
Lung aucultation				
Lung sounds and surface anatomy				
Orientation of bronchi and inhalation of foreign objects				
Plain chest radiography				
CT imaging of chest				
Bronchoscopy				
Lung cancers				
Spread of tumors via lymphatics				
Surgical opening of pericardium and the sinuses				
Pain and referred pain associated with the pericardium				
Pericardial effusions				
Constrictive pericarditis (jugular venus pulse)				
Pericardiocentesis				
Pericardial tamponade				
Beck's triad				
Heart outline on chest radiographs				
Cardiac valvular disease				
Coronary heart disease				
Coronary angioplasty (anatomy of)				
Pain and referred pain associated with the heart				
Interartrial septal heart defect				
Patent foramen ovale				
Probe patency				
Ostium secundum ASD				
Endocardial cushion with ostium primum ASD				

(Continues)

TABLE 10. Continued

Topic	Core	Recommended	Not recommended	Not core
Sinus venosus defect				
Common atrium				
Ventriculoseptal heart defect				
Membranous VSD				
Muscular VSD				
Swiss cheese VSD				
Common ventricle				
Transposition of the great arteries				
Patent ductus arteriosus				
Coarctation of the aorta				
Dextrocardia				
Ectopia Cordis				
Persistent trunctus arteriosus				
Ectopic parathyroids				
Aorticopulmonary window defect				
Fallot's tetralogy				
Pulmonary atresia				
Hypoplastic left heart syndrome				
Pulmonary valve defects				
Aortic valve defects				
Appearance of great vessels of mediastinum on chest radiographs				
Anatomy of central venous access				
Trauma to aorta and aortic dissection				
Variations in origins of the great vessels				
The aortopulmonary window and left recurrent laryngeal n.				
Common sites for compression of the esophagus				
Lymphatics and oesophageal cancer				
Safe triangle for chest drain insertion				
Foreign bodies bronchi/lungs				
Compression of recurrent laryngeal n				
Tracheal compression				
Aortic aneurysm				
Tracheosophageal fistula				
Achalasia				
Barrett's esophagus				
Chylothorax				

between 30 and 59% of the panelists classified an item as being essential, the topic was designated as being "recommended." Classification of "just acceptable" or "not required" came when the panelists only recorded essential designations between 20 and 29% and less than 20%, respectively. It is at this stage that our findings are presented to a wider-ranging audience through this article and on the IFAA website.

The Delphi panel is not involved in Stages 2 and 3 of the development of a core IFAA syllabus. At these stages, the IFAA relies upon comments from learned societies and from individual academics and medical clinicians from across the world. Thus, on a regular and continuous basis, further review and modification of a core syllabus takes place by the Federative International Programme for Anatomical Education (FIPAE) of the IFAA.

FINDINGS

The results of the Delphi Panel's deliberations for different topics related to thoracic anatomy are presented in Tables 1–10. Note that for consistency of development of this initial syllabus, where a topic is classified as "recommended" but just approaches "core" (i.e., being classified as being "essential" by almost 60% of responding Delphi panelists), it is moved into the "core" category.

DISCUSSION

Although the IFAA, in commissioning the development of core syllabuses for the anatomical sciences through its international educational program (FIPAE), is committed to producing detailed syllabuses rather than adopt a "broad brush" approach, there will be a need to reconcile the findings from different approaches (i.e., developing learning outcomes or topic items). The time is not yet right for this "reconciliation" since, Stages 2 and 3 of the processes approved by the IFAA have yet to be completed and future projects will be required to develop IFAA core medical syllabuses for the abdomen and the pelvis and perineum.

Both the authors, and the IFAA, are mindful that any team of experts cannot dictate what should, or

should not, be taught and the IFAA agrees with the principle that a core syllabus must be sufficiently flexible to be amenable to regular review and change. Indeed, the IFAA's approach recognizes the importance of the initial input of "experts" to the formulation of a core syllabus but holds to the view that there must be regular updating from the whole community of stakeholders (including anatomists, scientists, clinicians, students, administrators, and those politico-educational forces that govern medical schools). Moreover, syllabuses must evolve over time as new material comes along and as old material ceases to be academically or clinically relevant. Therefore, even at this point, the authors would welcome comments that will be passed to FIPAE for their consideration as the syllabus goes to the second phase of evaluation.

The IFAA syllabuses aim to present universities and the medical community with internationally accepted standards by which to assure the public about the quality of healthcare provision. In this regard, there are implications for the belief that the biomedical sciences should be made more clinically relevant. This of course presupposes that there is a clear understanding of what can be considered core material within the medical syllabus. It is our firm belief that this can only be properly accomplished by having internationally recognized core syllabuses.

One of the advantages of employing a Delphi process is that interesting questions often arise concerning the lack of consensus following analysis. Indeed, during Stages 2 and 3 of the IFAA processes, the reasons for the failure to agree consensus on a question, or series of questions, can be explored. In the present case, consensus across the panel was clearly evident for most, but not all, topics. However, in contrast to the IFAA syllabuses already published, we were surprised that the list of core topics accords with the authors' expectations. Thus, at this stage, we could not discern topics omitted from the list of core topics that we felt were incorrectly "judged".

Finally, it must be asked: what is the purpose of a core syllabus? This question we raised in previous papers on core syllabuses (Moxham et al., 2014, 2015, 2018; Tubbs et al., 2014; Fakoya et al., 2017; Webb et al., 2018) and our answer remains unaltered—"While recognizing that it may be hard to obtain universal agreement on the details, a core syllabus should provide the minimum level of knowledge expected of a recently qualified medical graduate in order to carry out many clinical procedures safely and effectively (thus to ensure that students are not overloaded with facts). The aim is to set standards not impose them. Thus, the core syllabus does NOT dictate WHEN or HOW the syllabus is delivered…" (Moxham et al., 2015). In this context, it is pertinent to ask questions about the use of the term "core"! It is the belief of some that ONLY core material should be taught and examined. We would counter that notion by reminding readers that the strength of universities lies in them possessing different schools of thought. Furthermore, for a university education to be worthy of its name, students should be taken to the frontiers of knowledge, at least in some areas. What is however more concerning is the belief that core means ONLY that which is absolutely "essential" for the students to know. If this argument is followed then ONLY this "essential" knowledge is examined and the pass mark is, or approaches, 100%! Clearly, this would be impossible in practice and so by "core" we mean that material/items which the students should be taught. Should examiners just use very basic, and clinically very important, questions in their assessments then of course the pass mark will be high. This situation is to some extent ameliorated by courses where important material is returned to at different stages of a course (e.g., in a "spiral course"). In view of this, we would say that the core syllabus presented here for the teaching and learning of thoracic anatomy is the recommended syllabus of the IFAA and consequently we advocate that the material/topic we are recognizing as "essential" represents international norms that should be covered in a university's/medical school's curriculum.

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